

Advanced Solid-State Joining Processes for 2219 Aluminum Alloys, Phase I

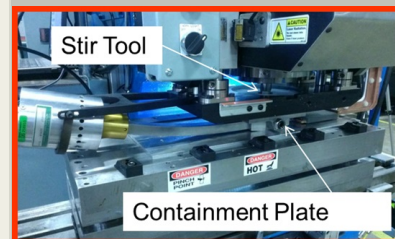
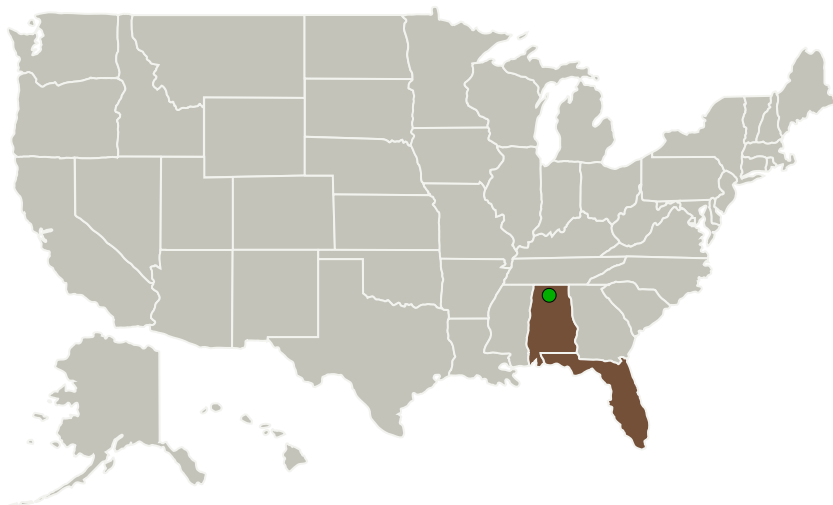
Completed Technology Project (2015 - 2015)



Project Introduction

Thermal Stir Welding (TSW) advances the more conventional Friction Stir Welding (C-FSW) process by separating the primary process variables of metal stirring and forging from the control of the workpiece temperature. The independent heating is obtained by placing an induction coil in front of a specially modified tool to bring the workpiece to the appropriate joining temperature. However, studies to date on joining of high melting temperature materials, such as nickel (Ni) based superalloys have shown high forces between the tool and workpiece, which compromise tool life. In response to this, the NASA-Marshall Space Flight Center (MSFC) has developed an advanced, subscale Ultrasonically Assisted (UA) TSW prototype. Incorporating UA into either the shoulder or pin during a FSW has shown a reduction in forces using lower melting temperature aluminum (Al) alloys. However, further work is needed to demonstrate the combined effect of UA with the TSW process for high melting temperature materials. In response to this need, Keystone is submitting this Phase I SBIR proposal to demonstrate the combined effects of UA with TSW on a Ni based superalloy of interest to the NASA.

Primary U.S. Work Locations and Key Partners



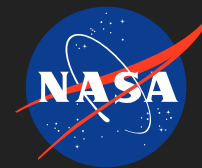
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Organizations Performing Work	Role	Type	Location
Keystone Synergistic Enterprises, Inc.	Lead Organization	Industry	Port Saint Lucie, Florida
● Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Florida

Project Transitions

▶ **July 2015:** Project Start

✓ **December 2015:** Closed out

Closeout Summary: Advanced Solid-State Joining Processes for 2219 Aluminum Alloys, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image(<https://techport.nasa.gov/file/138800>)

Images

**Briefing Chart Image**

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(<https://techport.nasa.gov/image/130749>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Keystone Synergistic Enterprises, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

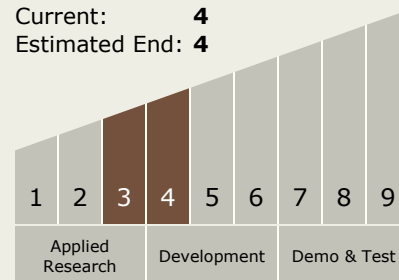
Carlos Torrez

Principal Investigator:

Bryant Walker

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - └ TX12.4 Manufacturing
 - └ TX12.4.1 Manufacturing Processes

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System